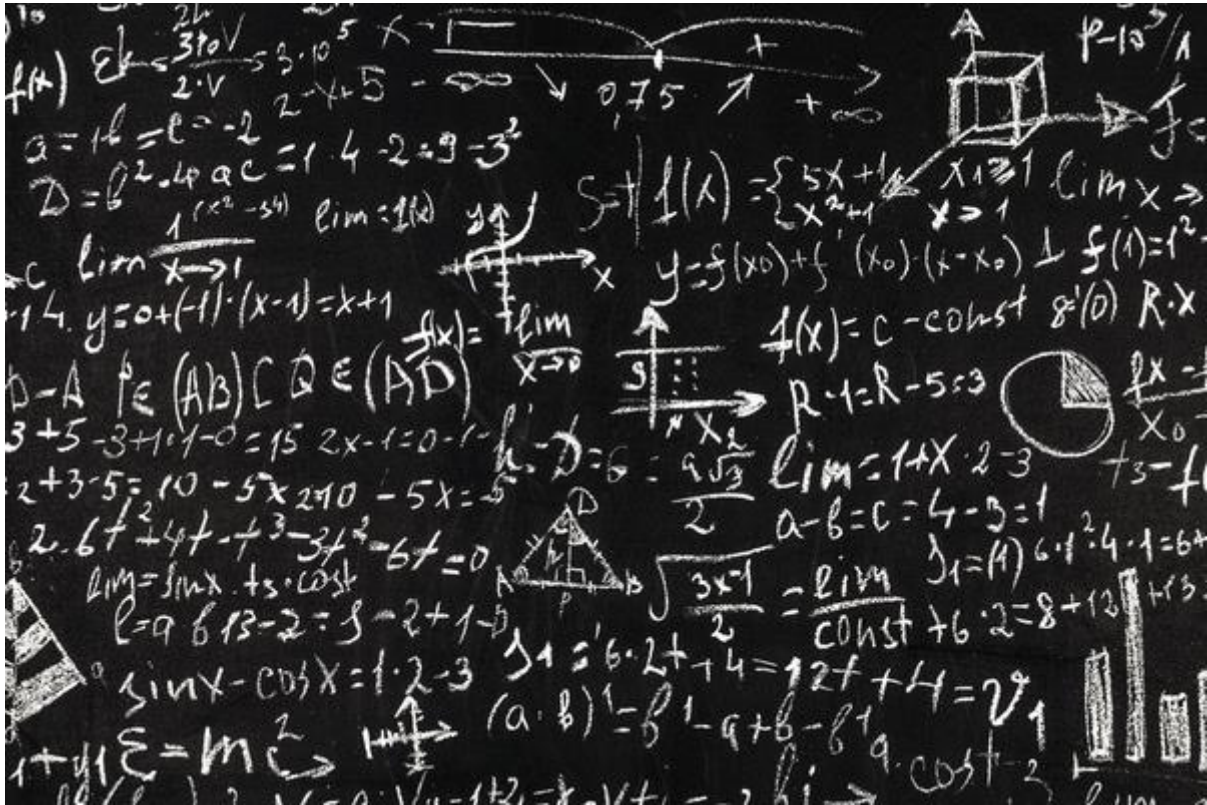# HILLCREST SIXTH FORM

Mathematics Welcome Pack

The Basics

Exam board and course information

Edexcel A-Level Mathematics - 9MA0

https://qualifications.pearson.com/content/dam/pdf/A%20Level/Mathematics/2017/specification-and-sample-assesment/a-level-l3-mathematics-specification-issue4.pdf

Equipment

Students of subject are expected to bring the following to every lesson:

- An Exercise Book/Lined Paper for note taking and answering questions.
- A folder to keep all the notes organised if using lined paper
- Plastic wallets for handouts
- Plastic wallet/A4 envelope folder for homework assignments
- Pen, pencil, ruler (30 cm is best).
- Scientific calculator (Casio fx – 991 CW as a minimum, but higher spec ones are advised)

What you can expect in this course

- Interesting lessons
- Thorough examples and opportunities to practice the new skills
- A range of resources to help you learn effectively and stay organised
- Lots of opportunity to share your ideas and challenge each other
- Homework tasks which help you to progress
- Excellent exam preparation

Expectations of all students

- Excellent attendance and punctuality
- That for every hour of lesson time you spend an hour outside of the lesson practicing the new skills
- To constantly be revising and reminding yourself of previous topics
- A positive attitude and good concentration in lessons
- Turning up fully-equipped to all lessons
- Homework completed on time and to the best of your ability; any homework completed on a computer should be printed by you *before* the lesson unless you are given directions to the contrary.
- Taking on board feedback you are given and using it to improve your work
- Constant review and revision throughout the course

Remember: there is a direct relationship between your effort and your final grade.

In short, we expect 100% commitment. You will be treated like a young adult in lessons and you are expected to behave like one: with maturity, conscientiousness, politeness and common sense.

Why Study A Level Mathematics?

Congratulations on choosing to study A Level Mathematics! This decision will undoubtedly open numerous doors for you in your future as A Level Maths is one of the best qualifications available to study at Sixth Form. It is known as a facilitating subject and one that is a benchmark for applications to jobs, University or Degree Apprenticeships.

Mathematics is highly valued by employers across various industries. Careers in engineering, finance, data science, actuarial science, economics, and computer science are particularly maths-intensive. The logical reasoning, problem-solving, and analytical skills developed through Maths is crucial in these fields. Additionally, careers in research, teaching, and even emerging fields like artificial intelligence and machine learning also benefit from a strong mathematical background.

Top universities highly regard A Level Mathematics. It is often a prerequisite for degrees in STEM (Science, Technology, Engineering, and Mathematics) fields. Even non-STEM subjects, such as economics, psychology, and business studies, appreciate the rigorous analytical training that mathematics provides. Prestigious universities, including those in the Russell Group in the UK and Ivy League in the US, look favorably upon applicants with Maths due to the subject's challenging nature and the skill set it imparts.

Mathematics complements and supports the understanding of various other A Level subjects. For instance:

- Physics and Chemistry: Both subjects rely heavily on mathematical principles for topics such as quantum mechanics, thermodynamics, and reaction rates.

- Economics: Mathematics is essential for understanding economic models, statistics, and data analysis.

- Computer Science: Algorithms, computational complexity, and logic are all rooted in mathematics.

- Biology: Statistical methods and data analysis play a significant role in genetics and ecological studies.

Studying A Level Mathematics develops a range of transferable skills:

- Critical Thinking: The ability to analyze and evaluate complex problems logically.

- Problem-Solving: Formulating strategies to tackle challenging questions and real-world scenarios.

- Attention to Detail: Precision in mathematical calculations and proofs enhances overall attention to detail in various contexts.

- Time Management: Balancing rigorous coursework with other subjects hones effective time management skills.

For many students, mathematics offers intellectual satisfaction through the challenge and the joy of solving complex problems. The logical structure and the definitive nature of mathematical solutions provide a sense of accomplishment and clarity.Maths is a universal language that transcends cultural and linguistic barriers. It equips students with skills that are applicable globally, making them more adaptable and competitive in an increasingly interconnected world.

A strong foundation in mathematics is crucial for higher studies in numerous disciplines. It forms the bedrock of advanced topics encountered in university courses and beyond. Moreover, many professional qualifications and postgraduate studies require a solid grasp of mathematical principles.

Choosing A Level Mathematics is a fantastic investment in your future. It not only provides a pathway to a wide array of exciting and lucrative careers but also equips you with essential skills that are highly valued in both academia and the job market. The analytical, problem-solving, and critical thinking skills honed through Maths ensure that you are well-prepared to tackle the challenges of university education and professional life. Whether you aim for a career in a STEM field, business, finance, or even the arts, A Level Mathematics serves as a powerful tool to achieve your goals.

Subject content

1. Pure Mathematics (66.7%)

Algebra and Functions:

- Polynomials: Polynomial expressions, factorization, and solving polynomial equations.

- Factor and Remainder Theorems: Application of these theorems to simplify and solve polynomial equations.

- Partial Fractions: Decomposition of rational functions into partial fractions.

- Algebraic Functions: Understanding and manipulating different types of algebraic functions, including rational, exponential, and logarithmic functions.

Coordinate Geometry:

- Lines and Circles: Equations of lines and circles, intersections, tangents, and normal lines.

- Parabolas: Equations and properties of parabolas, including their geometric significance.

Sequences and Series:

- Arithmetic Sequences and Series: General formulae, sum of terms, and applications.

- Geometric Sequences and Series: General formulae, sum of terms, convergence, and divergence.

Trigonometry:

- Trigonometric Functions: Sine, cosine, tangent, and their reciprocals, graphs, and properties.

- Trigonometric Identities and Equations: Pythagorean identities, double-angle, half-angle formulas, and solving trigonometric equations.

- Applications of Trigonometry: Real-world problems involving heights and distances.

Exponentials and Logarithms:

- Exponential Functions: Properties, graphs, and applications of exponential growth and decay.

- Logarithms: Laws of logarithms, solving logarithmic equations, and applications in various contexts.

Differentiation:

- Techniques: Rules of differentiation (product, quotient, chain rules), implicit differentiation.

- Applications: Finding tangents, normals, stationary points, and using differentiation in optimization problems.

Integration:

- Techniques: Indefinite and definite integrals, integration by substitution, integration by parts.

- Applications: Calculating areas under curves, volumes of revolution, and solving differential equations.

Numerical Methods:

- Solving Equations: Methods such as, Newton-Raphson method, and fixed-point iteration (cobweb and spider).

- Numerical Integration: Trapezium rule,

Vectors:

- Properties: Vector addition, scalar multiplication.

- Applications: Geometry of lines and planes in three dimensions, vector equations, and solving geometrical problems.

Proof:

- Mathematical Proof Methods: Direct proof, proof by contradiction, proof by induction, and disproof by counterexample.

2. Applied Mathematics (33.3%)

Statistics (16.7%)

Statistical Sampling:

- Sampling Methods: Random sampling, stratified sampling, systematic sampling, and quota sampling.

- Uses and Limitations: Practical applications and limitations of different sampling techniques.

Data Presentation and Interpretation:

- Data Representation: Histograms, box plots, cumulative frequency diagrams, and scatter plots.

- Interpretation: Measures of central tendency (mean, median, mode) and measures of spread (range, interquartile range, variance, standard deviation).

Probability:

- Basic Concepts: Independent and dependent events, conditional probability, and the addition and multiplication rules.

- Probability Distributions: Binomial and normal distributions, their properties, and applications.

Statistical Distributions:

- Discrete Distributions: Binomial distribution, its probability mass function, mean, and variance.

- Continuous Distributions: Normal distribution, standard normal distribution. Normal approximation of binomial distribution.

Statistical Hypothesis Testing:

- Formulation: Null and alternative hypotheses.

- Testing: Use of binomial and normal distributions in hypothesis testing, significance levels, p-values and correlation

Mechanics (16.7%)

Quantities and Units:

- Fundamental Units: SI units for time, mass, length, force.

- Derived Units: Units for velocity, acceleration, momentum, and energy.

Kinematics:

- Motion in a Straight Line: Equations of motion under constant acceleration.

- Graphs of Motion: Displacement-time, velocity-time, and acceleration-time graphs.

Forces and Newton's Laws:

- Newton's Laws: Application to various systems, including friction, tension, and normal contact force.

- Equilibrium: Conditions for equilibrium, resolving forces.

Moments:

- Definition and Calculation: Moment of a force, conditions for rotational equilibrium.

- Applications: Lever problems, real-world applications involving moments.

Key Features

- Emphasis on problem-solving, mathematical modelling, and reasoning skills.

- Focus on understanding and applying mathematical concepts.

- Integration of real-world applications, especially in statistics and mechanics.

- Encouragement of technology use, including graphing calculators and software.

The Edexcel A Level Mathematics syllabus aims to provide students with a robust understanding of mathematical principles and techniques, preparing them for higher education and careers in mathematically intensive fields.

Study Skills

Students studying for the Edexcel A Level Mathematics qualification should develop a range of study skills to effectively grasp the material and succeed in their assessments. Here are the key study skills you should focus on:

1. Understanding Core Concepts

   - Master Fundamental Principles: Ensure a deep understanding of core mathematical concepts, including algebra, calculus, trigonometry, and statistics.

   - Conceptual Connections: Recognize the connections between different mathematical topics and how they integrate into broader mathematical theories.

2. Problem-Solving Skills

   - Practice Regularly: Solve a variety of problems to become proficient in applying mathematical techniques.

   - Analytical Thinking: Develop the ability to break down complex problems into simpler parts and analyze them methodically.

   - Application of Techniques: Be adept at using standard mathematical techniques in various contexts, especially in unfamiliar problems.

3. Mathematical Reasoning and Proof

   - Logical Thinking: Enhance skills in constructing logical arguments and proofs.

   - Critical Evaluation: Critically evaluate the steps and methods used in solving problems to ensure accuracy and validity.

   - Proof Techniques: Get comfortable with different types of mathematical proof, such as direct proof, proof by contradiction, and induction.

4. Effective Communication

   - Clear Explanations: Practice explaining mathematical concepts and solutions clearly and concisely.

   - Mathematical Notation: Use correct mathematical notation and terminology to communicate ideas effectively.

   - Structured Solutions: Organize solutions logically and coherently, making it easy for examiners to follow the reasoning process.

5. Time Management

- Study Plan: Develop and follow a study plan that allocates sufficient time for each topic and includes regular review sessions.

- Practice Under Exam Conditions: Take timed practice exams to get accustomed to working under time constraints and managing time effectively during actual exams. This is one of the bigger challenges of A Level Maths – the time pressure is far more challenging than at GCSE.

6. Use of Resources

- Textbooks and Online Resources: Utilize textbooks, online tutorials, and other educational resources to reinforce understanding and gain different perspectives on topics.

- Past Papers: Regularly practice with past exam papers to familiarize with the exam format and types of questions asked.

- Study Groups: There can be positives to studying in groups in order to benefit from collaborative learning and gain insights from peers.

7. Technology Skills

- Graphing Calculators: Become proficient in using graphing calculators for solving problems and visualizing mathematical concepts if you are able to obtain a graphing calculator.

- Mathematical Software: Familiarize with mathematical software tools that can aid in complex calculations and visualizations.

8. Self-Assessment and Reflection

- Regular Self-Assessment: Continuously assess understanding through quizzes, practice problems, and self-tests.

- Reflect on Mistakes: Reflect on errors made in practice problems and exams to understand where improvements are needed.

- Seek Feedback: Actively seek feedback from teachers and peers to identify areas for improvement.

9. Adaptability and Resilience

- Adapt Learning Strategies: Be open to adjusting study techniques and strategies based on what works best for understanding and retaining information.

- Resilience: Develop resilience to cope with challenging problems and setbacks, viewing them as opportunities to learn and improve.

By developing these study skills, students can enhance their understanding, improve their problem-solving abilities, and perform well in their Edexcel A Level Mathematics assessments.

Scheme of Work

Our current AS scheme of work, however this is reviewed annually and might be different next year.

1A	4/9		revision of GCSE to A Level topics 2 Quadratics, 3 simultaneous	revision of GCSE to A Level topics 4 graph & transformations 5 straight line graphs	revision of GCSE topics entry to A Level assessment
2B	11/9				
3A	18/9				
4B	25/9				
5A	2/10				central tendency variation
6B	9/10				
7A	16/10		Unit 3 Binomial expansion	Unit 4 Trigonometry Ratios	graphical representation
8B	23/10				
Half term					
9A	6/11		Unit 3 Binomial Expansion		models
10B	13/11				
11A	20/11				
12B	27/11				
13A	4/12				kinematics
14B	11/12		Unit 3 Algebraic methods (excluding proof)	Unit 4 Trigonometry identities	
15A	18/12				probability
Christmas					
16B	8/1				
17A	15/1				
18B	22/1				Newton's laws
19A	29/1				
20B	5/2		Unit 6 Differentiation	Unit 5 Vectors	vectors
Half term					
21A	19/2				Sampling
22B	26/2				probability distributions
23A	4/3				
24B	11/3		Unit 8 Exponentials and logarithms	Unit 7 Integration	binomial hypothesis testing
25A	18/3				
Easter					
26B	8/4				Correlation
27A	15/4				Correlation
28B	22/4				
29A	29/4		Unit 8 Exponentials and logarithms	Unit 7 Integration	variable acceleration
30B	6/5				
31A	13/5		Proof	Proof	

32B	20/5		Proof	Proof	
Half term					
33A	3/6		End of year Assessment	End of Year Assessment	
34B	10/6		binomial expansion A2	binomial expansion A2	A2 correlation hypothesis testing
35A	17/6				
36B	24/6		arithmetic series, progressions A2	arithmetic series, progressions A2	
37A	1/7				moments A2
38B	8/7				
39A	15/7				
40B	22/7				

Our current A2 scheme of work, however this is reviewed annually and might be different next year.

	w/b		Pure A2	Applied A2
1A	4/9		Algebraic methods: binomial expansion, partial fractions simplifying expressions - algebraic division	Forces at an angle Friction - Newtons laws and SUVAT horizontally Newtons laws and SUVAT on a slope
2B	11/9			
3A	18/9			
4B	25/9			Normal distribution: introduction Shape of the graph, inflection points Calculator use - Inverse Normal
5A	2/10		Trigonometry: inverse functions, graphs compound and double angle proving identities, $a\cos\theta + b\sin\theta = R(\cos\theta + \alpha)$ Trig modelling	
6B	9/10			
7A	16/10			Projectiles
8B	23/10			
Half term				
9A	6/11		Review of Arithmetic Series etc from Year 12	Projectiles
10B	13/11		Differentiation: product, quotient and chain trig and exponential functions points of inflection connected rates of change - modelling	Probability: review of Year 12 conditional probability
11A	20/11			
12B	27/11			
13A	4/12			Geometric series and sequences
14B	11/12		Functions: modulus functions modelling with functions	
15A	18/12			3D vectors
Christmas				
16B	8/1		Integration: limit of a summation standard trig, exponential functions reverse chain rule, by parts partial fractions, substitution	Statics
17A	15/1			
18B	22/1			
19A	29/1			Numerical methods: trapezium rule Iterative methods, Newton-Raphson
20B	5/2		Proof: review of AS methods	
Half term				
21A	19/2		Proof by contradiction	Hypothesis testing: p values Normal distribution hypothesis tests Normal approximation to the Binomial
22B	26/2		Differential equations	
23A	4/3			
24B	11/3			Vector variable acceleration

25A	18/3		Parametric equations Parametric integration and modelling	
Easter				

Assessment

Your final grade in this subject will come from three exams at the end of year 13:

Assessment Structure

1. Paper 1: Pure Mathematics 1

   - Content: Pure Mathematics topics

   - Weighting: 33.33%

   - Duration: 2 hours

   - Marks: 100

2. Paper 2: Pure Mathematics 2

   - Content: Pure Mathematics topics

   - Weighting: 33.33%

   - Duration: 2 hours

   - Marks: 100

3. Paper 3: Statistics and Mechanics

   - Content: Statistics and Mechanics topics

   - Weighting: 33.33%

   - Duration: 2 hours

   - Marks: 100

Assessment Objectives (AOs)

1. AO1: Use and apply standard techniques (48–52%)

Skills Assessed:

   - Accurately recall and use standard mathematical techniques.

   - Solve problems requiring the application of standard mathematical methods.

Examples:

   - Performing algebraic manipulations.

- Solving equations and inequalities.

- Differentiating and integrating functions.

2. AO2: Reason, interpret and communicate mathematically (23–27%)

Skills Assessed:

- Construct logical arguments and proofs.

- Interpret and communicate mathematical information accurately.

- Make deductions and inferences.

Examples:

- Formulating mathematical arguments.

- Communicating solutions clearly and effectively.

- Understanding mathematical notations and terminology.

3. AO3: Solve problems within mathematics and in other contexts (23–27%)

Skills Assessed:

- Translate problems in context into mathematical forms.

- Use mathematical models to solve real-world problems.

- Evaluate the effectiveness of mathematical models.

Examples:

- Applying mathematical knowledge to solve problems in mechanics and statistics.

- Using mathematical reasoning to interpret data and make predictions.

- Evaluating the appropriateness of models and methods used.

Weighting of Assessment Objectives

- AO1: 48–52%

- AO2: 23–27%

- AO3: 23–27%

Integration in Examinations

- The assessment objectives are integrated across the three examination papers (Pure Mathematics 1, Pure Mathematics 2, and Statistics and Mechanics).

- Each paper assesses a mix of the three objectives to ensure a balanced evaluation of students' skills and understanding.

- Questions are designed to require a combination of recalling facts, applying techniques, reasoning, and problem-solving in various contexts.

These assessment objectives are aimed at evaluating students' mastery of mathematical concepts, their ability to apply these concepts in different scenarios, and their skill in logical reasoning and communication.

Throughout the course, you will be primarily be assessed through end of topic quizzes. We also get students to complete mock papers at key points over the two years which are currently

1) End of Year 12, to check progress over the first year
2) November of Year 13, to provide an opportunity for students to improve their grade for UCAS predictions
3) March/April of Year 13, once all content is complete to see where the areas of strength

Edexcel have provided the following summaries of their exams:

Paper 1: Pure Mathematics 1 (*Paper code: 9MA0/01)
Paper 2: Pure Mathematics 2 (*Paper code: 9MA0/02)
Each paper is:
2-hour written examination
33.33% of the qualification
100 marks
Content overview   • Topic 1 – Proof   • Topic 2 – Algebra and functions   • Topic 3 – Coordinate geometry in the (x, y) plane   • Topic 4 – Sequences and series   • Topic 5 – Trigonometry   • Topic 6 – Exponentials and logarithms   • Topic 7 – Differentiation   • Topic 8 – Integration   • Topic 9 – Numerical methods   • Topic 10 – Vectors
Assessment overview   • Paper 1 and Paper 2 may contain questions on any topics from the Pure Mathematics content.   • Students must answer all questions.   • Calculators can be used in the assessment.

Paper 3: Statistics and Mechanics (*Paper code: 9MA0/03)

2-hour written examination

33.33% of the qualification

100 marks

Content overview

Section A: Statistics

- Topic 1 – Statistical sampling
- Topic 2 – Data presentation and interpretation
- Topic 3 – Probability
- Topic 4 – Statistical distributions
- Topic 5 – Statistical hypothesis testing

Section B: Mechanics

- Topic 6 – Quantities and units in mechanics
- Topic 7 – Kinematics
- Topic 8 – Forces and Newton's laws
- Topic 9 – Moments

Assessment overview

- Paper 3 will contain questions on topics from the Statistics content in Section A and Mechanics content in Section B.
- Students must answer all questions.
- Calculators can be used in the assessment.

Tracking your progress

*Note on target grades: these are generated automatically by an organisation called LPUK, based on national averages about what people with similar GCSE grades to you go on to achieve in sixth form **if they push themselves**. They are **not what you will automatically get**, they are **not necessarily what you will be predicted on your UCAS or any other applications** and they are absolutely **not the maximum you can achieve**. What you achieve in sixth form will depend on **how much work you put in**. Your target grade is intended to be something for you to work towards: for you to try to do as good as or better than.*

Your LPUK target grade:

Date	Assessment title	Mark/grade	Focus for improvement

Useful resources and taking your work further

With Sixth Form studies, there is no such thing as "finished all your work".

The following websites have great practice questions:

https://www.mathsgenie.co.uk/alevel.php

https://www.physicsandmathstutor.com/

https://alevelmathsrevision.com/#

There are plenty of places that offer paid resources too but it's often better to club together to share those logins and talk to us first to ensure that they have the right things before you hand over money!